PATENT ABSTRACTS OF JAPAN

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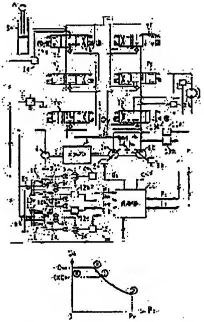
(54) HYDRAULIC DRIVE DEVICE

(57)Abstract:



PROBLEM TO BE SOLVED: To lessen an operational burden for an operator to adjust a bucket motion locus in swinging a hydraulic shovel and elevating a boom.

SOLUTION: When weight in a bucket increases the value of k × Qbm becomes smaller than the value of Qbo. Thus, a control part 15 performs a process 29, so as to keep Qb equal to k × Qbm. A regulator 3b controls a pump at k × Qbm, smaller than an ordinary target delivery flow Qbo, and at a target delivery flow Qb2 for power oontrol. As a result. the delivery flow Qb of a hydraulic pump 2b changes like a process from (a) to (d) via (b) along iso-power curves. In this case, the hydraulic pump 2a is in a normal control state through positive control and power control. and delivers a target delivery flow Qa1, corresponding to the positive control, or a target delivery flow Qa2 corresponding to the power control. A boom, however, cannot be elevated much, due to a heavy load. A delivery flow from the hydraulic pump 2b is, therefore, kept at a corresponding lower level, and the speed of a slewing motor 8b is lowered, thereby maintaining a good balance between a boom elevation amount 1b and the swinging amount sw thereof. regardless of a load.

CLAIMS

[Claim(s)]
[Claim 1]The 1st and 2nd variable capacity hydraulic pumps.
Two or more actuators which drive with pressure oil breathed out from said 1st and 2nd variable capacity hydraulic pumps, and contain a turning motor and a boom cylinder, The 1st valve group containing the 1st directional selecting valve that switches the direction of pressure oil which is connected to a discharge pipeline of said 1st variable capacity hydraulic pump, and is supplied to said turning motor, The 2nd valve group containing the 2nd directional selecting valve that switches the direction of pressure oil which is connected to a discharge pipeline of said 2nd variable capacity hydraulic pump, and is supplied to said boom cylinder.
A drive detection means to be the hydraulic drive provided with the above and to detect whether said turning motor and a boom cylinder are driving, A boom load detection means to output a detecting signal which detects bottom pressure of said boom cylinder and corresponds, When it is detected that both said turning motor and a boom cylinder are driving by said drive detection means, according to a detecting signal from a boom load detection means, it has a limit means which restricts a discharge flow amount of said 1st variable capacity hydraulic pump.

[Claim 2]The 1st control means that controls stroke quantity of said 1st directional selecting valve in the hydraulic drive according to claim 1, The 1st manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 1st control means, and oorresponds, The 2nd control means that controls stroke quantity of said 2nd directional selecting valve, The 2nd manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 2nd control means, and corresponds, The 1st setting-out means that sets up the 1st target displacement volume of said 1st variable capacity hydraulic pump according to a manipulated variable signal from said 1st manipulated variable detection means, Have further the 1st pump control means that controls displacement volume of said 1st variable capacity hydraulic pump based on this 1st target displacement volume, and and said drive detection means, A manipulated variable signal from said 1st and 2nd manipulated variable detection means judges whether it is larger than a value of a predetermined neutral zone, and it said limit means, Have the 2nd setting-out means that sets up the 2nd target displacement volume according to a detecting signal from said boom load detection means, and the 1st selecting means that chooses and outputs the smaller one among said 1st target displacement volume and said 2nd target displacement volume, and said 1st pump control means, A hydraulic drive controlling displacement volume of said 1st variable capacity hydraulic pump based on target displacement volume outputted from said 1st selecting means.
[Claim 3]A resisting means which generates control pressure according to a flow of pressure oil which is installed in the downstream of a center bypass line which passes said 1st directional selecting valve in the hydraulic drive according to claim 1, and flows into the downstream of said center bypass line, A pressure detection means which outputs a pressure detection signal which detects control pressure generated in this resisting means, and corresponds, The 3rd setting-out means that sets up the 3rd target displacement volume of said 1st variable capacity hydraulic pump according to a pressure detection signal from this pressure detection means, The 2nd

pump control means that controls displacement volume of said 1st variable capacity hydraulic pump based on this 3rd target displacement volume. The 1st control means that controls stroke quantity of said 1st directional selecting valve, The 1st manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 1st control means, and corresponds. The 2nd control means that controls stroke quantity of said 2nd directional selecting valve, Have further the 2nd manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 2nd control means, and corresponds. and judge whether said drive detection means has a manipulated variable signal larger than a value of a predetermined neutral zone from said 1st and 2nd manipulated variable detection means, and said limit means. The 4th setting-out means that sets up the 4th target displacement volume according to a detecting signal from said boom load detection means, Have the 2nd selecting means that chooses and outputs the smaller one among said 3rd target displacement volume and said 4th target displacement volume, and said 2nd pump control means. A hydraulic drive controlling displacement volume of said 1st variable capacity hydraulic pump based on target displacement volume outputted from said 2nd selecting means.

[Translation done.]

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3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the hydraulic drive which drives a hydraulic excavator especially with respect to the hydraulic drive which drives the work machine of a hydraulic drive.
[0002]
[Description of the Prior Art]As conventional technology concerning this kind of hydraulic drive, international publication number WO92/18710 have a thing of a statement, for example. In this known art, an operator chooses three kinds of pump flow characteristics memorized by ROM of the control device via a selecting arrangement, and the discharge flow amount of a hydraulic pump is controlled according to these selected pump flow characteristics. Thereby, according to work contents, the control characteristic (NEGAKON characteristic) of a directional selecting valve is switched, and good operativity is secured to the work of a different kind.
[0003]
[Problem(s) to be Solved by the Invention]Generally, revolution boom raising operation is operation performed frequently in work operation of a hydraulic excavator, and it is operation with being repeatedly carried [much] out so that a bucket may moreover pass along the same locus. Here, in the above-mentioned known art, by choosing the pump flow characteristics according to a work kind, it can compare, when doing all the work with the same pump flow characteristics, and it can work now efficiently with little energy. For example, when rating, such as digging loading work, is required, it has the 1st pump flow characteristics as suitable pump flow characteristics, and when trying to perform revolution boom raising operation, these 1st pump flow characteristics will be chosen. However, in the above-mentioned known art, if the loaded object weight in a bucket changes from the oil pressure load change of the boom cylinder by the loaded object weight change in the bucket under this revolution boom raising operation not being considered working, the maximum stream flow in which the regurgitation of a pump is possible will change. Therefore, since in such a case it had to adjust so that an operator might adjust lever handling according to the weight of the loaded object in a bucket and a bucket might pass along the same moving track, operation became complicated and the adjustment operation burden of the operator was heavy.
[0004]The purpose of this invention is to provide the hydraulic drive which can reduce the operation burden of the bucket moving track adjustment by an operator in revolution boom raising operation of a hydraulic excavator.
[0005]
[Means for Solving the Problem]According to this invention, to achieve the above objects, the 1st and 2nd variable capacity hydraulic pumps. Two or more actuators which drive with pressure oil breathed out from said 1st and 2nd variable capacity hydraulic pumps, and contain a turning motor and a boom cylinder. The 1st valve group containing the 1st directional selecting valve that switches the direction of pressure oil which is connected to a discharge pipeline of said 1st variable capacity hydraulic pump, and is supplied to said turning motor. In a hydraulic drive which has the 2nd valve group containing the 2nd directional selecting valve that switches the direction

of pressure oil which is connected to a discharge pipeline of said 2nd variable capacity hydraulic pump, and is supplied to said boom cylinder, A drive detection means to detect whether said turning motor and a boom cylinder are driving, A boom load detection means to output a detecting signal which detects bottom pressure of said boom cylinder and corresponds, When it is detected that both said turning motor and a boom cylinder are driving by said drive detection means, a hydraulic drive having a limit means which restricts a discharge flow amount of said 1st variable capacity hydraulic pump according to a detecting signal from a boom load detection means is provided.

[0006]The 1st control means that controls stroke quantity of said 1st directional selecting valve in said hydraulic drive preferably, The 1st manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 1st control means, and corresponds, The 2nd control means that controls stroke quantity of said 2nd directional selecting valve, The 2nd manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 2nd control means, and corresponds, The 1st setting-out means that sets up the 1st target displacement volume of said 1st variable capacity hydraulic pump according to a manipulated variable signal from said 1st manipulated variable detection means, Have further the 1st pump control means that controls displacement volume of said 1st variable capacity hydraulic pump based on this 1st target displacement volume, and and said drive detection means, A manipulated variable signal from said 1st and 2nd manipulated variable detection means judges whether it is larger than a value of a predetermined neutral zone, and it said limit means, Have the 2nd setting-out means that sets up the 2nd target displacement volume according to a detecting signal from said boom load detection means, and the 1st selecting means that chooses and outputs the smaller one among said 1st target displacement volume and said 2nd target displacement volume, and said 1st pump control means, A hydraulic drive controlling displacement volume of said 1st variable capacity hydraulic pump based on target displacement volume outputted from said 1st selecting means is provided.

[0007]In said hydraulic drive, it is preferably installed in the downstream of a center bypass line which passes said 1st directional selecting valve, A resisting means which generates control pressure according to a flow of pressure oil which flows into the downstream of said center bypass line, A pressure detection means which outputs a pressure detection signal which detects control pressure generated in this resisting means, and corresponds, The 3rd setting-out means that sets up the 3rd target displacement volume of said 1st variable capacity hydraulic pump according to a pressure detection signal from this pressure detection means, The 2nd pump control means that controls displacement volume of said 1st variable capacity hydraulic pump based on this 3rd target displacement volume, The 1st control means that controls stroke quantity of said 1st directional selecting valve, The 1st manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 1st control means, and corresponds, The 2nd control means that controls stroke quantity of said 2nd directional selecting valve, Have further the 2nd manipulated variable detection means that outputs a manipulated variable signal which detects a control input of this 2nd control means, and corresponds, and judge whether said drive detection means has a manipulated variable signal larger than a value of a predetermined neutral zone from said 1st and 2nd manipulated variable detection means, and said limit means, The 4th setting-out means that sets up the 4th target displacement volume according to a detecting signal from said boom load detection means, Have the 2nd selecting means that chooses and outputs the smaller one among said 3rd target displacement volume and said 4th target displacement volume, and said 2nd pump control means, A hydraulic drive controlling displacement volume of said 1st variable capacity hydraulic pump based on target displacement volume outputted from said 2nd selecting means is provided.

[0008]Namely, in this invention constituted as mentioned above, If an operator means a revolution boom raising and operates the 1st directional selecting valve and 2nd directional selecting valve, First, pressure oil led via a discharge pipeline from the 1st variable-capacity pump is supplied to a turning motor via the 1st directional selecting valve provided in the 1st valve group, by this, a turning motor drives and a revolving super-structure of a hydraulic excavator circles. Pressure oil led via a discharge pipeline from the 2nd variable-capacity pump

is simultaneously supplied to a boom cylinder via the 2nd directional selecting valve provided in the 2nd valve group, a boom cylinder develops, and a boom of a hydraulic excavator is raised. Thus, revolution boom raising operation is performed and a driving state of a turning motor and a boom cylinder is detected by a drive detection means.

[0009]Thus, if a revolution boom raising state is detected by a drive detection means, bottom pressure of a boom cylinder, i.e., load added to a boom, will be detected by a boom load detection means, it will be outputted as a detecting signal, and a discharge flow amount of the 1st variable capacity hydraulic pump will come to be restricted by a limit means according to this. Namely, for example, when what is called positive control is performed, according to a control input of the 1st control means that controls stroke quantity of the 1st directional selecting valve, the 1st target displacement volume is set up by the 1st setting-out means, but. When a control input of the 1st and 2nd control means that control stroke quantity of the 1st and 2nd directional selecting valves is larger than a value of a predetermined neutral zone here, It is judged by a drive detection means that it is a driving state of a boom cylinder and a turning motor, and the 2nd [according to a detecting signal from a boom load detection means] target displacement volume is set up by the 2nd setting-out means with which a limit means was equipped. And the smaller one is chosen among these [1st] and the 2nd target displacement volume by the 1st selecting means. And according to this selected target displacement volume, displacement volume of the 1st variable capacity hydraulic pump is controlled by the 1st pump control means. Therefore, if a detecting signal from a boom load detection means beoomes large and it will set up in the 2nd setting-out means so that the 2nd target displacement volume may become smaller, Since the 2nd target displacement volume is larger than the 1st target displacement volume when [that weight in a bucket is light] boom load is comparatively small, The 1st target displacement volume is chosen by the 1st selecting means, and the usual pump control by the 1st target displacement volume is performed in the 1st pump control means. And since a way of the 2nd target displacement volume will become smaller than the 1st target displacement volume and the 2nd target displaoement volume will be chosen by the 1st selecting means if weight in a bucket becomes heavy and boom load becomes comparatively large, In the 1st pump control means, pump control by the 2nd target displacement volume smaller than the 1st usual target displacement volume comes to be performed.

[0010]For example, in a case where what is called negative control is performed, Control pressure according to a pressure oil flow is generated in a resisting means in the center bypass-line downstream which passes the 1st directional selecting valve, this control pressure is detected by a pressure detection means, and the 3rd [according to this] target displacement volume is set up by the 3rd setting-out means. A control input of the 1st and 2nd control means that control stroke quantity of the 1st and 2nd directional selecting valves is detected by the 1st and 2nd manipulated variable detection means here, When these control inputs are larger than a value of a predetermined neutral zone, it is judged by a drive detection means that it is a driving state of a boom cylinder and a turning motor. And the 4th [according to a detecting signal from a boom load detection means] target displacement volume is set up by the 4th setting-out means with which a limit means was equipped, and the smaller one is chosen among these [3rd] and the 4th target displacement volume by the 2nd selecting means. And according to this selected target displacement volume, displacement volume of the 1st variable capacity hydraulic pump is controlled by the 2nd pump control means.Therefore, if a detecting signal from a boom load detection means becomes large and it will set up in the 4th setting-out means so that the 4th target displacement volume may become smaller, Since the 4th target displacement volume is larger than the 3rd target displacement volume when [that weight in a bucket is light] boom load is comparatively small, The 3rd target displacement volume is chosen by the 2nd selecting means, and the usual pump control by the 3rd target displacement volume is performed in the 2nd pump control means. And since a way of the 4th target displacement volume will become smaller than the 3rd target displacement volume and the 4th target displacement volume will be chosen by the 2nd selecting means if it is heavy and weight in a bucket becomes comparatively large in boom load, In the 2nd pump control means, pump control by the 4th target displacement volume smaller than the 3rd usual target displacement volume comes to be performed.

[0011]That is, since a discharge flow amount from a variable-capacity pump of the part 1st becomes small and a swing speed becomes slow even if it is a case where boom load became large at the time of a revolution boom raising, and a boom climbing speed becomes slow, as explained above, balance of the amount of boom raisings and a turn amount is kept good.
[0012]
[Embodiment of the Invention]Hereafter, an embodiment of the invention is described, referring to drawings. Drawing 1 - drawing 6 explain a 1st embodiment of this invention. This embodiment is an embodiment in the case of being applied to a hydraulic excavator and controlling by what is called positive control of the discharge flow amount of a pump corresponding [and] to the maximum operation pressure of a directional selecting valve.
[0013]The hydraulic excavator with which the hydraulic drive by this embodiment is applied is provided with the following.
The right-hand side crawler belt and left-hand side crawler belt which forms a running body although not illustrated in particular
The revolving superstructure which constitutes the main part in which it is formed on this running body and a driver's seat is provided, and is driven with a turning motor (it illustrates by drawing 1 mentioned later).
The boom which it is provided in the front position of this revolving superstructure pivotable, and is driven by a boom oylinder (it illustrates by drawing 1 mentioned later).
The arm which it is provided in this boom pivotable and driven by an arm hydraulic cylinder, and the bucket which it is provided in this arm pivotable and driven by a bucket hydraulic cylinder.

[0014]The hydraulic-circuit figure of the hydraulic drive by this embodiment is shown in drawing 1. The hydraulic drive by this embodiment is provided with the following in drawing 1.
The right run motor which drives a right-hand side crawler belt as an actuator driven with the pressure oil which is provided with the pilot pump 4 of the hydraulic pump 2a of variable capacity, 2b, and fixed capacity, and is breathed out from the hydraulic pump 2a as a hydraulic pump driven with the engine 1 (not shown).
Bucket hydraulic cylinder (not shown).
It is the turning motor 8b as an actuator driven with the pressure oil which is provided with the boom cylinder 8a and breathed out from hydraulic-pump 2b.
An arm hydraulio oylinder (not shown) and the left run motor which drives a left-hand side crawler belt (not shown).

[0015]The directional-selecting-valve group which switches the flow direction of the pressure oil to each actuator is connected to the hydraulio pump 2a and 2b. First, the directional selecting valve 7c for a right run which controls the drive of a right run motor, and 7 d of directional selecting valves for buckets which control the drive of a bucket hydraulic cylinder and the directional selecting valve 7a for booms which controls the drive of the boom cylinder 8a are parallel connected to the hydraulic pump 2a. All of these directional seleoting valves are the pilot operating valves driven by pilot pressure, And it is the center bypass type valve provided with the meter yne passage, the meter out passage, and the center bypass channel, and as shown in drawing 1, the center bypass channel is connected so that it may become the order of the directional selecting valve 7c for a right run, 7 d of directional selecting valves for buckets, and the directional selecting valve 7a for booms. It is not what makes the important section of this embodiment about the directional selecting valve 7c for a right run, and 7d of directional selecting valves for buckets, and since publicly known composition is sufficient, the graphic display is omitted in part.
[0016]Next, the directional selecting valve 7b for revolution which controls the drive of the turning motor 8b, the directional selecting valve 7e for arms which controls the drive of an arm hydraulic cylinder, and 7 f of directional selecting valves for a left run which control the drive of a left run motor are parallel connected to hydraulic-pump 2b. These directional selecting valves as well as the above are center bypass type pilot operating valves altogether, and as shown in drawing 1, the center bypass channel is connected so that it may become the order of the

directional selecting valve 7b for revolution, the directional selecting valve 7e for arms, and 7 f of directional selecting valves for a left run. It is not what makes the important section of this embodiment about the directional selecting valve 7e for arms, and 7f of directional selecting valves for a left run, and since publicly known composition is sufficient, the graphic display is omitted in part.

[0017]The above directional selecting valves 7a-7f are valves of the pilot operated type altogether driven by pilot pressure as described above. For example, if the operation is explained taking the case of the directional selecting valve 7a for booms which makes the important section of this embodiment, After the pilot pressure generated from the pilot pump 4 was led to the pilot valve 10 for booms and decompressed via the pipeline 6a, According to the manipulating direction of the control lever 10A of the pilot valve 10 for booms, it is led to the signal port 17a of the directional selecting valve 7a for booms, or 17b via the piping 16a or 16b. After the pilot pressure generated from the pilot pump 4 was led to the pilot valve 11 for revolution and was similarly decompressed via the pipeline 6b about the directional selecting valve 7b for revolution, According to the manipulating direction of the control lever 11A of the pilot valve 11 for revolution, it is led to the signal port 19a of the directional selecting valve 7b for revolution, or 19b via the piping 18a or 18b. Although not explained in particular, a change is performed by the same operation also about other directional selecting valves 7c-7f.

[0018]Pressure sensor 12 a-d which outputs the signal which detects the above-mentioned pilot pressure, pump discharge pressure, and load pressure to the hydraulic drive of this embodiment, and corresponds to it to the control section 15, and 13a, 13b and 14 are provided. The operating pressure power detector 12a via the shuttle valves 5c and 5b or other shuttle valves which are not illustrated, The greatest thing is detected among the pilot pressure which operates the directional selecting valves 7c, 7d, and 7a connected to the discharge pipeline of the hydraulic pump 2a, and corresponding pressure signal S_{ia} is outputted to the control section 15. It is connected to the piping 16a and the boom raising operating pressure power detector 12b outputs pressure signal S_{bm} which detects and corresponds that the control lever 10A of the pilot valve 10 for booms was operated in the direction of a boom raising to the control section 15. Furthermore, it is connected to the piping 18a and b via 5 d of shuttle valves, and the gyrating operation pressure sensor 12c outputs pressure signal S_{sw} which detects and corresponds that the control lever 11A of the pilot valve 11 for revolution was operated in the direction of either to the control section 15. The operating pressure power detector 12d via the shuttle valves 5d and 5e or other shuttle valves which are not illustrated, The greatest thing is detected among the pilot pressure which operates the directional selecting valves 7b, 7e, and 7f connected to the discharge pipeline of hydraulic-pump 2b, and corresponding pressure signal S_{ib} is outputted to the control section 15. The pump discharge pressure sensor 13a is connected to the discharge pipeline of the hydraulic pump 2a, Output discharge-pressure signal P_a which detects the discharge pressure of the hydraulic pump 2a, and corresponds to the control section 15, and the pump discharge pressure sensor 13b, It is connected to the discharge pipeline of hydraulic-pump 2b, and discharge-pressure signal P_b which detects the discharge pressure of hydraulic-pump 2b and corresponds is outputted to the control section 15. It is connected to the bottom product side of the boom cylinder 8a, and the boom cylinder pressure sensor 14 outputs boom cylinder bottom pressure signal P_{bm} which detects bottom pressure and corresponds to the control section 15.

[0019]And the control section 15 performs predetermined data processing (after-mentioned) based on these pressure sensor 12 a-d and the detecting signal from 13a, 13b, and 14, The driving signal for making each pump 2a and the tilt angle of b into predetermined target discharge flow amount (target tilt angle) Q_a and Q_b (after-mentioned) is outputted to the hydraulic pump 2a and the regulators 3a and 3b which control the discharging volume (tilt angle) of b, respectively.

[0020]It explains along with drawing 2 in which the flow chart with which the arithmetic

processing content of the control section 15 is expressed for the operation in the above-mentioned composition is shown. The hydraulic pump 2a first detected by the pump discharge pressure sensors 13a and 13b in Procedure 20 in drawing 2, discharge-pressure signal P_a of 2b, and P_b, Pressure signal S_{ia} detected by the operating pressure power detector 12a, Pressure signal S_{ib} detected by the operating pressure power detector 12d, Pressure signal S_{bm} detected by the boom raising operating pressure power detector 12b, pressure signal S_{sw} detected by the gyrating operation pressure sensor 12c, and boom cylinder bottom pressure signal P_{bm} detected by the boom cylinder pressure sensor 14 are read.

[0021]Within next, limits which move to Procedure 21, are based on horsepower line figures, such as a predetermined pump input horsepower shown in drawing 3, and do not exceed a predetermined pump input horsepower. Maximum discharge flow amount Q_{a2}=g (P_a) of the hydraulic pump 2a corresponding to the value of discharge-pressure signal P_a and P_b and 2b and Q_{b2}=g (P_b) are computed. Based on the table shown in drawing 4, discharge flow amount Q_{a1}=f (S_{ia}) and Q_{b1}=f (S_{ib}) by positive control of the hydraulic pump 2a corresponding to the value of pressure signal S_{ia} and S_{ib} and 2b are computed. As the table at this time is shown in drawing 4, predetermined control input S_{i1} is minimum discharge Q_{min}. In control input S_{i1} - S_{i2}, it increases linearly from Q_{min} to maximum stream flow Q_{max} on control, and if control input S_{i2} is exceeded, it is set up become Q_{max}. And it is further based on horsepower line figures, such as a predetermined pump input horsepower shown in drawing 3, and maximum discharge flow amount Q_{bm}=e (P_{bm}) of hydraulic-pump 2b corresponding to boom cylinder bottom pressure signal P_{bm} is computed within limits which do not exceed a predetermined pump input horsepower. At this time, the value of Q_{bm} serves as a relation which becomes small, so that P_{bm} becomes large, as shown in drawing 3.

[0022]And it moves to Procedure 22, the direction which is the minimum among Q_{b1} and Q_{b2} which were computed in Procedure 21 is chosen, and this is made into target discharge flow amount Q_{bo} of hydraulic-pump 2b. That is, if it is $Q_{b1}<Q_{b2}$, it will be considered as $Q_{bo}=Q_{b1}$, otherwise, $Q_{bo}=Q_{b2}$.

[0023]And it moves to Procedure 25 further, the direction which is the minimum among Q_{a1} and Q_{a2} which were computed in Procedure 21 is chosen, and this is made into target discharge flow amount Q_a of the hydraulic pump 2a. That is, if it is $Q_{a1}<Q_{a2}$, it will be considered as $Q_a=Q_{a1}$, otherwise, $Q_a=Q_{a2}$.

[0024]Then, it moves to Procedure 28 and it is judged whether they are whether revolution boom raising operation is performed and $S_{sw}>S_{op}$ (value of the neutral zone used as the standard for judging that = pilot valve is operated), i.e., $S_{bm}>S_{op}$. When the conditions of Procedure 28 are fulfilled, it is judged that revolution boom raising operation is performed and it moves to Procedure 29. kxQ_{bm} which multiplied by the constant k which decides matching with revolution speed and boom raising speed to be Q_{bm} computed in Procedure 21 in Procedure 29. The minimum of the target discharge flow amount Q_{bo} computed in Procedure 22 is chosen, and this is made into final target discharge flow amount Q_b of hydraulic-pump 2b. That is, if it is $Q_{bo}<kxQ_{bm}$ and is $Q_b=Q_{bo}$ and $Q_{bo}>=kxQ_{bm}$, it will be considered as $Q_b=kxQ_{bm}$ and will move to Procedure 31. It is set up become $kxQ_{bm}<=Q_{max}$ (maximum stream flow on control) as shown in drawing 4 at this time. When the conditions of Procedure 28 are not fulfilled, it is judged that revolution boom raising operation is omitted, Q_{bo} calculated in Procedure 22 by Procedure 30 is made into final target discharge flow amount Q_b of hydraulic-pump 2b as it is, and it moves to

Procedure 31.
[0025]In Procedure 31, while outputting the driving signal for making the discharge flow amount of the hydraulic pump 2a into target discharge flow amount Q_a to the pump regulators 3a, the driving signal for making the discharge flow amount of hydraulic-pump 2b into target discharge flow amount Q_b is outputted to the pump regulators 3b.
[0026]After Procedure 31 is completed, it returns to Procedure 20, and the above-mentioned data processing is repeated and is performed.
[0027]In the above control, the usual control based on target discharge flow amount Q_{a1} of positive control according to maximum operation pressure S_{ia} always concerning the boom pilot valve 10 in the hydraulic pump 2a is performed first. Namely, the minimum of target discharge flow amount Q_{a1} of the positive control for which it asked in Procedure 21 of drawing 2 in the control section 15, and target discharge flow amount Q_{a2} by horse power control is chosen in Procedure 25 as final target discharge flow amount Q_a. It is outputted to the regulator 2a in Procedure 31.
[0028]Next, about hydraulic-pump 2b, the minimum of target discharge flow amount Q_{b1} of the positive control for which it asked in Procedure 21 of drawing 2 in the control section 15, and target discharge flow amount Q_{b2} by horse power control is chosen in Procedure 22, and is made into Q_{bo}. And correction by kxQ_{bm} based on boom load is further performed in Procedure 29 after that. That is, when [that the weight in a bucket is light] boom load is comparatively small, as mentioned above, Q_{bm} is comparatively large, and since the way of kxQ_{bm} therefore becomes larger than Q_{bo}, Q_{bo} is chosen in Procedure 29 and it becomes $Q_b=Q_{bo}$. Therefore, the usual pump control by target discharge flow amount Q_{b1} of positive control and target discharge flow amount Q_{b2} of horse power control is performed by the regulator 3b.
[0029]And if the weight in a bucket becomes heavy and boom load becomes comparatively large, Qbm is comparatively small, and since the way of kxQ_{bm} becomes smaller than Q_{bo}, kxQ_{bm} will be chosen in Procedure 29 and it will become $Q_b=kxQ_{bm}$. Therefore, in the regulator 3b, pump control by kxQ_{bm} smaller than the usual target discharge flow amount Q_{bo} and target discharge flow amount Q_{b2} of horse power control comes to be performed, Discharge flow amount Q_b of hydraulic-pump 2b changes an horsepower line figure top, such as a predetermined input horsepower shown in drawing 5, like a->b->d. Namely, when such boom load is large, since the usual control by positive control and horse power control is performed as the hydraulic pump 2a was mentioned above — the hydraulic pump 2a — target discharge flow amount Q_{a1} of positive control — or the regurgitation of the target discharge flow amount Q_{a2} of horse power control is carried out. However, since the load of the boom cylinder 8a is large at this time, a boom seldom goes up. By then, the thing for which the discharge flow amount from the part which seldom goes up, and hydraulic-pump 2b is made small, and speed of the turning motor 8b is made late as mentioned above. The balance of amount of boom raisings l_b and turn amount $_{sw}$ is kept good for load not related, and the relation between turn amount theta$_{sw}$ and amount of boom raisings l_b can be changed like a->b->d of drawing 6.
[0030]On the other hand, in the former which does not correct the discharge flow amount of the above hydraulic-pump 2bs, the usual control based on target discharge flow amount Q_{b1} of positive control and target discharge flow amount Q_{b2} of horse power control is always performed also with hydraulic-pump 2b. Therefore, drawing 5 sets, it changes like a->b->c until the discharge flow amount of hydraulic-pump 2b becomes maximum discharge flow amount Q_{max}, and thereby, turn amount theta$_{sw}$ of the turning motor 8b increases at an increasing tempo in drawing 6, and as shown by solid line a->b->c, it changes. Therefore, it was necessary for an

operator to perform adjustment operation of the amount of gyrating operation, corresponding to a boom cylinder burden in work with a larger turn amount. Since according to this embodiment suffering troubles and adjusting is lost in order to coincide a bucket moving track, the operation burden of an operator can be reduced.
[0031]Next, drawing 7 - drawing 9 explain a 2nd embodiment of this invention. This embodiment is an embodiment in the case of controlling the discharge flow amount of a pump by what is called negative control. The same numerals are given to a member equivalent to a 1st embodiment. The hydraulic-circuit figure of the hydraulic drive by this embodiment is shown in drawing 7. In drawing 7, the main points that the hydraulic drive by this embodiment differs from the hydraulic drive of a 1st embodiment, The diaphragms 21a and 21b are formed in the directional selecting valves [7a and 7f] center bypass-line downstream, respectively. The differential pressure detector 20a which detects the differential pressure before and behind these diaphragms 21a and 21b, and outputs corresponding differential pressure signal P_{na} and P_{nb} to the control section 15, and b are provided, It is with that the pressure sensors 12a and 12d in a 1st embodiment are omitted, and the thing which data processing in the control section 15 differs corresponding to these (after-mentioned). Other composition is the same as that of a 1st embodiment almost.
[0032]It explains along with drawing 8 in which the flow chart with which the arithmetic processing content of the control section 15 is expressed for the operation in the above-mentioned composition is shown. The hydraulic pump 2a first detected by the pump discharge pressure sensors 13a and 13b in Procedure 220 in drawing 8, discharge-pressure signal P_a of 2b, and P_b. Differential pressure signal P_{na} detected by the differential pressure detector 20a, and differential pressure signal P_{nb} detected by the differential pressure detector 20b, Pressure signal S_{bm} detected by the boom raising operating pressure power detector 12b, pressure signal S_{sw} detected by the gyrating operation pressure sensor 12c, and boom cylinder bottom pressure signal P_{bm} detected by the boom cylinder pressure sensor 14 are read.
[0033]Within next, limits which move to Procedure 221, are based on horsepower line figures, such as a predetermined pump input horsepower shown in drawing 3 like a 1st embodiment, and do not exceed a predetermined pump input horsepower. Maximum discharge flow amount Q_{a2}=g (P_a) of the hydraulic pump 2a corresponding to the value of discharge-pressure signal P_a and P_b and 2b and Q_{b2}=g (P_b) are computed. Based on the table shown in drawing 9, discharge flow amount Q_{a1}=h (P_{na}) and Q_{b1}=h (P_{nb}) by negative control of the hydraulic pump 2a corresponding to the value of differential pressure signal P_{na} and P_{nb} and 2b are computed. As the table at this time is shown in drawing 9, predetermined NEGAKON differential pressure P_{n1} is maximum stream flow Q_{max} on control. In NEGAKON differential pressure P_{n1} - P_{n2}, it decreases linearly from Q_{max} to minimum discharge Q_{min}, and if NEGAKON differential pressure P_{n2} is exceeded, it is set up become Q_{min}. Within and limits which are based on horsepower line figures, such as a predetermined pump input horsepower shown in drawing 3, like a 1st embodiment, and do not exceed a predetermined pump input horsepower. Maximum discharge flow amount Q_{bm}=e (P_{bm}) of hydraulic-pump 2b corresponding to boom cylinder bottom pressure signal P_{bm} is computed.
[0034]Since subsequent Procedures 22 - Procedures 31 are the same as that of a 1st embodiment almost, explanation is omitted. And after Procedure 31 is completed, it returns to Procedure 220, and the above-mentioned data processing is repeated and is performed.
[0035]In the above control, the usual control based on target discharge flow amount Q_{a1} of the negative control of the hydraulic pump 2a always corresponding to NEGAKON differential pressure P_{na} is performed first. Namely, the minimum of target discharge flow amount Q_{a1} of the negative control for which it asked in Procedure 221 of drawing 8 in the control section 15, and

target discharge flow amount Q_{a2} by horse power control is chosen in Procedure 25 as final target discharge flow amount Q_a. It is outputted to the regulator 2a in Procedure 31.

[0036]Next, about hydraulic-pump 2b, the minimum of target discharge flow amount Q_{b1} of the negative control for which it asked in Procedure 221 of drawing 8 in the control section 15, and target discharge flow amount Q_{b2} by horse power control is chosen in Procedure 22, and is made into Q_{bo}. And after that, when [that the weight in a bucket is light] boom load is comparatively small, The way of kxQ_{bm} becomes larger than Q_{bo}. Q_{bo} is chosen in Procedure 29, and the usual control by target discharge flow amount Q_{b1} of negative control and target discharge flow amount Q_{b2} of horse power control is performed by the regulator 3b.

[0037]And if the weight in a bucket becomes heavy and boom load becomes comparatively large, kxQ_{bm} will be chosen in Procedure 29 and it will become Q_b=kxQ_{bm}. Therefore, in the regulator 3b, pump control by kxQ_{bm} smaller than the usual target discharge flow amount Q_{bo} and target discharge flow amount Q_{b2} of horse power control comes to be performed. That is, the balance of amount of boom raisings l_b and turn amount $_{sw}$ is kept good for load not related by making small the discharge flow amount from hydraulic-pump 2b like a 1st embodiment for a part for a boom to seldom go up, and making speed of the turning motor 8b late.

[0038]Also by this embodiment, the same effect as a 1st embodiment is acquired.

[0039]

[Effect of the Invention]According to this invention, since the discharge flow amount from the variable-capacity pump of the part 1st becomes small and a swing speed becomes slow even if it is a case where boom load became large at the time of a revolution boom raising, and a boom climbing speed becomes slow, the balance of the amount of boom raisings and a turn amount is kept good. Therefore, since suffering troubles and adjusting is lost in order that it may compare with the amount of boom raisings and a turn amount may coincide a bucket moving track like before which becomes extremely large, the operation burden of an operator can be reduced.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a hydraulic-circuit figure of the hydraulic drive by a 1st embodiment of this invention.
[Drawing 2]It is a figure showing the flow chart showing the arithmetic processing content of the control section shown in drawing 1.
[Drawing 3]They are horsepower line figures, such as a predetermined pump input horsepower used by data processing of the flow chart shown in drawing 2.
[Drawing 4]It is a figure showing the relation of the control input and pump discharge flow which are used by data processing of the flow chart shown in drawing 2.
[Drawing 5]It is a figure showing change of the discharge flow amount of a hydraulic pump.
[Drawing 6]It is a figure showing the relation between the amount of boom raisings, and a turn amount.
[Drawing 7]It is a hydraulic-circuit figure of the hydraulic drive by a 2nd embodiment of this invention. It is a figure.
[Drawing 8]It is a figure showing the flow chart showing the arithmetic processing content of the control section shown in drawing 7.
[Drawing 9]It is a figure showing the relation between the differential pressure signal used by data processing of the flow chart shown in drawing 8, and a pump discharge flow.
[Description of Notations]
1 Engine
2a Hydraulic pump (the 2nd variable capacity hydraulic pump)
2b Hydraulic pump (the 1st variable capacity hydraulic pump)
3a and b Regulator (pump control means)
4 Pilot pump
5 b-e shuttle valve
6a and b Pipeline
7a The directional selecting valve for booms
7b The directional selecting valve for revolution
7c The directional selecting valve for a right run
7 d Directional selecting valve for buckets
7e The directional selecting valve for arms
7 f Directional selecting valve for a left run
8a Boom cylinder
8b Turning motor
10 The pilot valve for booms (the 2nd control means)
10A Control lever
11 The pilot valve for revolution (the 1st control means)
11A Control lever
12a Operating pressure power detector (the 2nd manipulated variable detection means)
12b Boom raising operating pressure power detector
12c Gyrating operation pressure sensor

12 d Operating pressure power detector (the 1st manipulated variable detection means)
13a, b pump discharge pressure sensor
14 Boom cylinder pressure sensor (load detection means)
15 Control section (a setting-out means, limit means)
16a and b Piping
17a, b signal port
18a and b Piping
19a, b signal port
20a and b Differential pressure detector (pressure detection means)
21a and b It extracts (resisting means).

[Translation done.]

* NOTICES *

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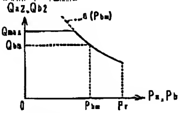
damages caused by the use of this translation.

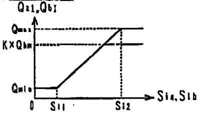
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

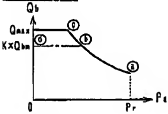
[Drawing 3]



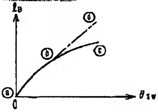
[Drawing 4]



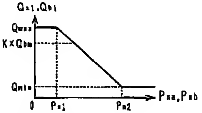
[Drawing 5]



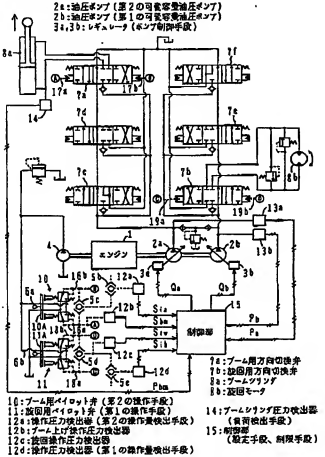
[Drawing 6]



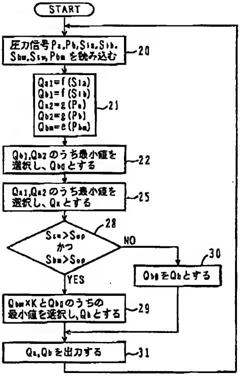
[Drawing 9]



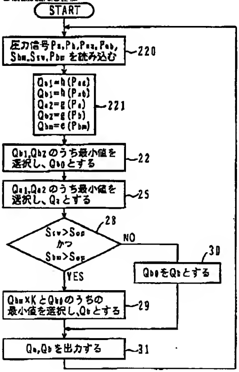
[Drawing 1]



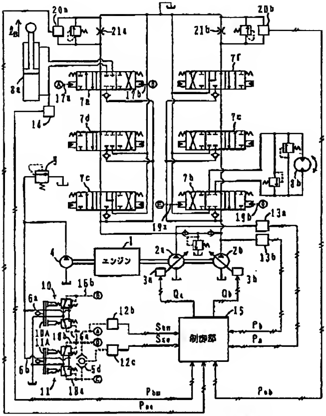
[Drawing 2]



[Drawing 8]



[Drawing 7]



20a,20b:差圧検出器（圧力検出手段）
21a,21b:絞り（抵抗手段）

[Translation done.]